A biopsychosocial interpretation of the Neuropsychiatric Inventory-Nursing Home (NH): reconceptualising psychiatric symptom attributions

Sarah J. Smith, PhD[1], Alys W. Griffiths PhD[1], Byron Creese PhD[2], Cara Sass[1] & Claire A. Surr PhD[1]

[1]Centre for Dementia Research, Leeds Beckett University

[2]College of Medicine and Health, University of Exeter Medical School

Corresponding Author:

Dr Sarah Jane Smith, PhD

Centre for Dementia Research

Leeds Beckett University

Leeds, UK

Email: s.j.smith@leedsbeckett.ac.uk

Telephone: +44 1138124665

Word Count: 3573

Abstract

Background: The Neuropsychiatric Inventory is predicated on the assumption that psychiatric symptoms are manifestations of disease. Biopsychosocial theories suggest behavioural changes viewed as psychiatric may also arise as a result of external behavioural triggers. Knowing the causes of psychiatric is important since the treatment and management of psychiatric symptoms relies on this understanding.

Aims: This study sought to understand the causes of psychiatric symptoms recorded in care home settings by investigating qualitatively described symptoms in NPI-NH interviews.

Method: The current study examined the NPI-NH interviews of 725 participants across 50 care homes. The qualitatively described symptoms from each of the 12 subscales of the NPI were extracted: 347 interviews included at least one qualitatively described symptom (n=651 descriptions). A biopsychosocial algorithm developed following a process of independent researcher coding (n=3) was applied to the symptom descriptions. This determined whether the description had predominantly psychiatric features, or features that were cognitive or attributable to other causes (i.e. issues with Orientation & Memory, Expressions of Need, Poor Care and Communication or Understandable Reactions)

Results: Our findings suggest that the majority (over 80%) of descriptions described symptoms with features that could be attributable to cognitive changes and external triggers (e.g. poor care and communication).

Conclusions: The finding suggest that in its current form the NPI-NH may over attribute the incidence of psychiatric symptoms in care homes by overlooking triggers for behavioural changes. Measures of psychiatric symptoms should determine the causes of behavioural changes in order to guide treatments more effectively.

Funding: The report is based on research commissioned and funded by the National Institute for Health Research Health Technology Assessment programme [redacted].

Data Sharing Statement

The data collected for this study can be made available by contacting the corresponding author.

Declaration of Interest: None

Author Contributions: All authors meet the criteria for authorship stated in the Uniform Requirements for Manuscripts Submitted to Biomedical Journals. SS contributed to the analysis and interpretation of data, drafting of the article and revisions for critical content and final approval of the article. AG contributed to data collection, analysis and interpretation of data, revisions for critical content and final approval of the article. BC contributed to data collection, interpretation of data, revisions for critical content and final approval of the article. CSass contributed to the data analysis, interpretation of data, revisions for critical content and final approval of the article. CS contributed to the design of the study, interpretation of data, revisions for critical content and final approval of the article.

Introduction

Psychiatric symptoms are common in dementia and include disturbances of mood, perception and behaviour such as depression, apathy, disinhibition and hallucinations[1]. The prevalence of psychiatric symptoms in care home residents ranges from 40-85%[2] representing a challenge for care providers and policy makers. Although treatment includes pharmacological and non-pharmacological options, prescribing antipsychotics to manage psychiatric symptoms is contentious due to limited efficacy and long lasting side effects[3]. Providing and developing appropriate and effective treatments relies on the accurate identification of psychiatric symptoms as they occur.

The Neuropsychiatric Inventory (NPI;[4]) represents a well-established measure of psychiatric symptoms in dementia frequently used in RCTs of pharmacological and non-pharmacological interventions[5,6]. The Neuropsychiatric Inventory – Nursing Home version[7] is a proxy interview based measure, predicated on ten behavioural and two neuro-vegetative categories.

However, there are noted limitations of the NPI (and subsequent NPI-NH). Namely that they are predicated on the assumption that psychiatric symptoms are manifestations of disease[4], and not designed to distinguish between behaviours caused by disease and behaviours that represent a reaction to the physical or social environment[5].

Since the NPI was developed the extent to which pathology contributes to psychiatric symptoms, and the degree to which neurological and psychiatric symptoms overlap in dementia, has been debated. For example Crossley et al. (2015) sought to determine, by meta-analysis of neuroimaging evidence, whether distinct brain regions are implicated in psychiatric and neurological symptoms; comparing the brain regions that had been implicated in 24 psychiatric and neurological conditions (as described in the ICD-10), drawing on data from at least 7 VBM studies for each disorder. The disorders included several types of

dementia and psychiatric disorders. Their findings implicated distinct regions in psychiatric (cingulate, medial frontal, superior frontal and occipital cortex) versus neurological (Basal ganglia, insula, sensorimotor and temporal cortex) disorders. In their initial analysis dementia was classified as a neurological disorders, although dementias are described as both neurological and psychiatric in the ICD-10. Confirmatory analysis in which the dementias (Alzheimer's, frontotemporal and dementia in Parkinson's disease) were classified as psychiatric disorders was also conducted. In this subsequent confirmatory analysis, classifying dementias as psychiatric disorders led to changes in the degree to which temporal regions were associated with psychiatric disorders. The temporal cortex was primarily implicated in neurological disorders when dementias were classified as neurological, whereas it was primarily implicated in psychiatric disorders when dementias were classified as psychiatric.

These findings speak to the difficulty of classifying psychiatric symptoms in dementia. Dementia is primarily considered a neurological disorder associated with cognitive symptomology, with the tendency for psychiatric symptoms to manifest in later stages[9]. Only in less common types of dementia are psychiatric symptoms a hallmark of the dementia phenotype e.g. frontal dementia and DLB[10]. The findings from Crossley et al. which indicate that brain regions associated with cognitive symptoms are implicated when dementia is treated as a psychiatric may suggest that cognitive changes drive psychiatric symptoms in dementia.

This view is consistent with a biopsychosocial approach, in which psychiatric symptoms can be understood as arising from the interplay between neurological changes expressed as cognitive symptoms and environmental triggers, or as the result of understandable reactions to care being provided. If this is the case then symptoms may be amenable to be treatment by manipulating or changing the environment or caregiving interactions.

A range of external factors may cause expression of psychiatric symptoms in dementia, such as unmet needs and lack of activity[11], environmental triggers[12], and the interactions between people with dementia and their caregivers[13]. A biopsychosocial (BPS) approach can be applied to understand the degree to which behavioural changes are a function of the interaction between the person (including neurobiological changes and cognitive symptoms), their personal history and personality, and the social environment in which they exist[14].

The NPI-NH in its current form endorses reporting behaviours as part of a unified neuropsychiatric symptomology regardless of the degree to which the symptom is predicated on cognitive, psychiatric or external triggers. For example, one of the questions related to symptoms of agitation is "Does the resident get upset when people are trying to care for him/her or resist activities such as bathing or changing clothes?" in the context of the NPI a person experiencing reluctance and distress when entering a bathroom would be unilaterally labelled as agitated. Applying the principles of a BPS approach the same behaviours may represent an understandable reaction to the distress caused by not understanding why they are entering a bathroom (cognitive changes) and having personal clothing removed by a stranger (external cues).

Recent studies using the NPI have identified that levels of psychiatric symptoms vary across settings suggesting that the NPI is picking up on environmental cues, even though this is not being recorded[15]. For example, lower levels of apathy are observed in services where there are more staff led activities for residents. This indicates that although the NPI does not seek to distinguish between environmentally triggered behaviours it is sensitive to environmental and social triggers.

In the current study we sought to explore the types of behaviours described as psychiatric symptoms in the NPI-NH, adopting an approach similar to previous research in clinical

settings that used algorithms to distinguish between neurological (cognitive) and psychiatric symptoms[10]. Previous studies have sought to determine where symptoms predominantly cluster, for example 1) primary cognitive syndromes where the cognitive deficits are the signal features 2) psychiatric syndromes in which the psychiatric symptoms are the primary features[10,16].

The present study adopted a similar algorithmic approach, with the additional consideration of the degree to which environmental triggers and caregiver interactions contributed to the described symptoms by analysing qualitative descriptions of symptoms recorded by researchers on the NPI-NH.

In summary, the present study sought to explore the nature of symptoms rated as psychiatric in a large randomised controlled trial, and understand the impact of applying an alternative algorithm that accounted for psychiatric, cognitive, environmental, and care related factors on overall NPI-NH scores.

Method

Participants

Participants (N = 725) were recruited from 50 care homes (M = 15 residents per care home) as part of a randomized controlled trial[17] (blinded for review), we present baseline only. Permanent residents with a formal diagnosis of dementia or a score ≥4 on the Functional Assessment Staging Test of Alzheimer's disease (FAST)[18] were recruited. Residents were ineligible if they had been formally admitted to an end of life care pathway or were cared for in bed. The average age was 85.7 (range: 57-102). The majority of participants were female (536; 74%) and identified as White British (702; 96%). One participant was removed due to missing data.

Measures

158 The Neuropsychiatric Inventory Nursing Home version (NPI-NH[7]) was completed for all
159 participants by a staff proxy with a researcher. This measure consists of 12 subscales e.g.
160 delusions, hallucinations. For each subscale the NPI-NH includes a number of predetermined
161 questions to identify whether specific behaviour are present e.g. under agitation/aggression
162 "Does the resident shout, make loud noises, or swear angrily?" For each subscale there is also
163 an 'other' response (except for 'aberrant') where staff can provide qualitative description
164 behaviours that don't reflect the predetermined questions. For aberrant behaviours the
165 qualitative component simply asks raters to provide more information.

166 If the proxy respondent answers yes to any predetermined question or provides a description
167 of an "other" behaviour they are asked to report how frequently the behaviour(s) occur on a
168 4-point scale (rarely to very often), the severity of the symptoms (mild, moderate or severe)
169 and their occupational disruptiveness on a 6-point scale (not at all to very severely). In this
170 study we analysed the qualitative descriptions of behaviours recorded in the "other" category.

171 *Data preparation*

172 Prior to algorithm development cases where no qualitative description was entered in any of
173 the symptom categories were removed. This provided a total of 347 participants, who had a
174 qualitative description of at least one symptom (median = 2, range = 1-8).

175 *Algorithm development*

176 Three of the authors trained in the use of the NPI (SS, AG, and CS) independently
177 thematically coded symptoms with qualitative descriptions for 1/3 of the 347 participants.
178 The independent coding was predicated on a biopsychosocial approach, as first purported by
179 Kitwood[19] in the Enriched Model of dementia, and subsequently updated to inform
180 approaches to practice[20] and person-centred care[21].

The process described in figure 1 was followed by each independent rater for each qualitative description of a symptom. The qualitative symptoms varied in length and detail. For example "*Selectively resistant*" (Agitation); "*Used to sing along with the radio, it is not that she has lost interest. She does not have the ability to do activities/interests any more*" (Apathy); "*If staff are walking past, she requires attention. Will call out and ring bell. Can be aggressive if attention not given e.g. hit staff*" (Agitation). The researchers examined the descriptions from biopsychosocial perspective and noted where there was information that could indicate a causal interpretation of the behaviour, behavioural trigger, or information that might suggest that the behaviour does not meet the threshold for being pathological or abnormal. For example "*Doesn't like loud noise - leaves room*". The raters then shared their interpretations of behaviours indicating causal features that could be identified in the symptom description or alternative behavioural explanations. These were reviewed across the three raters and themes were elicited that captured the potential biopsychosocial interpretations of symptoms. These themes were generated by examining how each rater had described potential causal factors, behavioural triggers or alternative interpretations that featured in the description, and generating categories based on the similarities between these features. For example, features described as negative communication, malignant social psychology, or negative staff interaction were grouped into the theme "Poor Care and Communication". In the resulting algorithm there are four ways in which the symptoms can be interpreted. Where it is identified that symptoms cluster around predominantly cognitive and environmental triggers, four biopsychosocial interpretations of symptoms can be considered; issues with Orientation & Memory (O&M), Expressions of Need (EoN), Poor Care and Communication (PCC) and Understandable Reactions (UR). The algorithm is presented in Figure 1.

[Figure 1]

Role of the funder

The report is based on independent research commissioned and funded by the National Institute for Health Research Health Technology Assessment programme [redacted]. The views and opinions expressed are those of the authors and do not necessarily reflect those of the HTA, NIHR, NHS or the Department of Health and Social Care.

Ethics

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human subjects/patients were approved by NRES Committee Yorkshire and the Humber-Bradford Leeds REC [redacted] Written informed consent was obtained from all subjects.

Findings

Testing the Algorithm for Reliability

Having established the algorithm, each rater independently applied the algorithm to the dataset (347 participants and 651 qualitative symptom descriptions). The reliability of the algorithm was interrogated by establishing interrater reliability. We were interested in the consistency of rating symptoms as either 1) predominantly psychiatric symptoms (PS), 2) predominantly cognitive involving environmental triggers allocated on of the four biopsychosocial categories (O&M, PC&C, EoN, UR), or 3) being coded in error (six codes in total). Agreement between the raters was calculated in three ways for each subscale on the NPI NH; the percentage agreement of categorisation of symptoms between raters, Krippendorfs alpha (K alpha) and the mean Kappa agreement between the rating pairs e.g. (*k*RaterA&B+*k*RaterA&C+ *k*RaterB&C)/3 (see appendix A supplementary materials). Good percentage agreement was greater than 75%. Moderate Kappa agreement >·40, good

agreement is greater than >·60. Scores >·57 are considered to represent good agreement using the Krippendorf calculation[22].

Overall none of the subscales represented poor agreement across all agreement outcomes, although were subject to variations across the methods. The subscale that demonstrated weakest agreement using the Krippendorf and Kappa statistic was Elation. This is likely due to the very few (n=10) qualitatively described instances of this behaviour; percentage agreement was generally good. Conversely, Agitation and Anxiety demonstrated weaker percentage agreement but good agreement using Krippendorf and kappa statistics, likely due to the greater number of instances and thus variability.

Overall, there were only 7 instances in which at least two raters were not in agreement regarding the symptom description. The findings indicate that overall the framework used is a reliable indicator for the qualitatively described symptoms.

Applying the Algorithm to the dataset

The algorithm was applied to all 651 qualitatively described symptoms in the dataset. Disagreement between raters regarding was resolved by consensus agreement. If at least two raters were not in agreement a discussion between the raters informed the final categorisation. The number of symptoms associated within each primary coding category is presented in Table 1.

Overall, most (75%) of the qualitatively described symptoms were correctly assigned as psychiatric symptoms based on the NPI-NH manual descriptors. However, when considering biopsychosocial explanations for the behaviour, 59% of these behaviours were predominantly attributed to other causes, and only 16% were coded as predominantly psychiatric. Of the remaining 25% of symptoms, 22% represented symptoms predominantly attributable to other causes (CEC) that should not have been assigned as psychiatric symptoms based on the NPI-

NH manual. An example from from the depression category is "*Upset when family don't visit*" which was understood using the algorithm as an understandable reaction. Finally, 3% of symptoms were recorded in error and did not represent behaviours relevant to the sub-scale. For example, "*Aggression*" (Depression).

[Table 1]

Patterns of classification were relatively consistent across the subscales. The highest proportions of items assigned correctly as psychiatric symptoms but under the algorithm attributable to predominately cognitive or environmental triggers (NPI CEC) was in the Sleep and Delusions subscales. The subscale of Apathy appeared to be the least understood, with 43% of symptoms being incorrectly assigned as psychiatric symptoms (CEC). For example, "*When he is tired he will sleep, not do new things*." The symptoms classified as predominately cognitive involving environmental cues or care interactions (NPI CEC and CEC) were further examined under the four biopsychosocial categories (see table 2).

[Table 2]

Overall, the majority (58%) of symptoms examined within these categories (NPI CEC or CEC) were attributable to expression of need (EoN). In the Aberrant behaviour category 90% of the symptom descriptions related to expressions of need. For example, "*shakes hands and squeezes hands" and "going to the toilet excessively and becoming fidgety"*. With the exception of the sub-categories Delusions, Hallucinations and Agitation, expression of need was the most common code applied to the qualitatively described symptoms.

In the category of Delusions the most frequent attribution (50/59) for the symptom described was problems with Orientation and Memory (O&M). Behaviours described in this category were associated with problems with recognition memory, long-term memory or orientation. For example*, "believes family members are in the building and she needs to find them" and*

"thinks she needs to go home to see her husband and children". In the sub-category of hallucinations five of the nine symptoms were coded as problems with Orientation & Memory (e.g. *looks in mirror / sees own reflection but talks as if it is someone else*).

The majority of symptoms that were not predominantly psychiatric in the subscale of agitation were related to poor care and communication (PC & C) (40 instances). For example, *"can be physically aggressive, particularly if her frame is taken away. She grabs/snatched at things*". Many of these described behaviours occurred during personal care. For example, "*fearfullness, can freeze and go rigid and it makes personal care difficult"*. Although a high number of symptoms in this category (32) were expressions of need (EoN). For example, *"if staff are walking past, she requires attention", "will call out and ring bell" and "can be aggressive if attention not given e.g. hit staff"*.

Many instances of depression were assigned correctly as psychiatric according to the manual but with a biopsychosocial lens represented predominantly cognitive features involving environmental cues or care interactions (CEC). These were attributed to either an expression of need (e.g. *"crying sometimes in relation to pain" and "waking during the night"*) or understandable reactions (e.g. *"wants to go home. Misses daughter. Quiet and sleepy"* and *"upset when family don't visit"*).

Overall, there were very few instances of elation; according to the algorithm the majority represented expressions of need, (e.g. *"tends to hug carers arms during these periods" and "hugging and kissing"*). Similarly, the majority of disinhibition behaviours were coded as expressions of need. For example, "*very in the moment - takes clothes off if wet or uncomfortable" and "will take food from other residents, will pick at himself in public areas if defecated". Impulsively asking non-verbally for cigarettes or food*.

Overall NPI scores

To understand the impact of applying the algorithm on the total NPI score we compared overall standard NPI-NH scores of the 725 participants with their scores with the qualitatively described symptoms removed. As described, total NPI scores are derived from the frequency x severity scores in each sub category. Removing the influence of the qualitatively described symptoms means that the frequency x severity ratings are not reported when they are derived solely from the qualitatively described symptom. T-tests were conducted for (see Table 3). The inclusion of qualitatively described symptoms described in the "other" category had a significant impact on the overall NPI score ($t=6{\cdot}14$ $df=24$ $p<{\cdot}01$). The NPI score indicates a higher degree of severity when the qualitatively described symptoms are included; the sub categories of delusions, anxiety, depression and irritability contribute to this effect.

[Table 3]

Discussion

Our findings suggest that the majority of qualitatively described symptoms in the NPI may relate to symptoms that are predominantly cognitive involving environmental triggers or care interactions. This raises questions about how the NPI is, or should be, used the context of informing individualised care and evaluating care practices. In the context that the NPI was designed, a medicalised explanation was attributed to all behaviours labelled as symptoms. Our findings suggest that the NPI overestimates the presence of predominantly psychiatric symptoms. Removing qualitatively described symptoms in our sample caused significant reductions in overall NPI score.

In our findings around 60% of the symptoms were attributed correctly according to the manualised instructions of the NPI-NH, which does not require raters to account for the causes of the behaviours. However, around 25% of the symptoms were reported as

psychiatric symptoms in error; i.e. contrary to the NPI-NH manual, suggesting issues with user administration. Of the 651 symptoms we applied the biopsychosocial algorithm to only 16% were coded as predominantly psychiatric.

The findings are in line with previous suggestions that the NPI-NH is limited by failing to take account of the other causes or explanations for behaviours[5,23]. It is important to understand causes for behaviour in order to guide treatments and interventions. Our suggestion is the NPI-NH in its current form may over medicalise symptoms by suggesting that they are predominantly psychiatric, when symptoms may represent understandable reactions to care interactions or environmental cues that are modifiable. This has significant clinical implications in cases in which the NPI is used to guide treatment decisions i.e. unnecessary psychiatric prescriptions.

In line with Zuidema et al., who found NPI-NH rated apathy to be lower in environments where more activities are provided, our findings also suggest that symptoms can reflect the physical or social environment. In turn these may represent proxy indicators of poor care or less enriched care environments. Across all categories, symptoms were most commonly attributed to being expressions of need. In the context of a person-centred model of behaviour, expressions of need tend occur in the absence of good person-centred care[24]. For agitation, the majority of symptoms reflected poor care or communication; for example *"can be physically aggressive, particularly if her frame is taken away".* In this instance the cue (removal of walking aid) impacts on sense of safety/comfort, or may restrict independence. In the context of a biopsychosocial approach this behaviour may be reduced by reassuring the individual that the walking aid is nearby, or not removing the aid in the first instance.

Although behaviours were commonly seen as expressions of need, they were attributable to different causes at different rates across the sub-categories. An example of this was observed

in the sub-category of delusions, in which the majority if the symptoms described could be attributed to difficulties with Orientation and Memory, a common dementia symptomology e.g. *"thinks she needs to go home to see her husband and children"*. This symptom can be understood in the context of the patient experiencing Anosogosia (unawareness), which results from the long-term memory deficit common to Alzheimer's disease related to hippocampal pathology[25]. According to Morris' model of Anosognosia[26] the experience results from the failure of the individuals' ability to update their personal memory store. This includes personal semantic and episodic information, such as where the person is now living, meaning the person thinks they still live in the place they previously called home. Thus, the individual is unaware that they are currently living in a care home. Amendments to the wording and administration guidelines of the NPI-NH could be implemented to ensure that predominantly cognitive and non-cognitive symptoms are not conflated.

Likewise some NPI-NH sub-scales such as Agitation/Aggression include predetermined questions that describe predominantly environmentally triggered behaviours, and therefore potentially encourage raters to see all agitated behaviours as predominantly psychiatric. For example, *Does the resident get upset when people are trying to care for him/her or resist activities such as bathing or changing clothing?* Revising NPI-NH wording to ensure that the wording it does not promote recording behaviours that are likely to have social or environmental causes, or to ensure that the predominant cause of the behaviour is recorded, is recommended.

Our findings did suggest an element of user error. Previous findings have also suggested adaptions to the NPI-NH may improve its reliability by making it more accessible to care staff, such as adopting a diarised method with greater scope to record behavioural antecedents[27]. Our findings would additionally recommend that users of the NPI-NH tool have a good understanding of biopsychosocial approaches to care in order to distinguish

between triggers or alternative attributions for behaviour. The findings of this study also suggest that NPI-NH might be reviewed to recognise alternative interpretations and cuases of behaviours. This may require further research, development and validation with consideration of the NPI-NH training, instruction manual and administration and recording procedures.

In summary, this study has investigated the nature of qualitative descriptions of psychiatric symptoms in the NPI-NH and the degree to which these behaviours may or may not represent predominantly psychiatric symptoms. Our findings suggest that a significant proportion symptoms may be predominantly cognitively rooted and/or environmentally triggered. It may be feasible and useful for amendments to be made the NPI-NH that distinguish between causes of symptoms and additional consideration be given to these factors in NPI administration and training. This would result in greater accuracy in recording predominately psychiatric symptoms in dementia and would align to best practice recommendations with regards to informing person centred non-pharmacological treatment options as first line treatments.

References

1. Lyketsos C, Carrillo M, Ryan J, Khachaturian A, Trzepacz P, Amatniek J et al. Neuropsychiatric symptoms in Alzheimer's disease. Alzheimer's & Dementia. 2011;7(5):532-539.
2. Livingston G, Sommerlad A, Orgeta V, Costafreda S, Huntley J, Ames D et al. Dementia prevention, intervention, and care. The Lancet. 2017;390(10113):2673-2734.
3. Banerjee S. The use of antipsychotic medication for people with dementia: time for action. A report for the Minister of State for Care Services London: Department of Health, 2009. Accessed 12 August 2019.
4. Cummings J, Mega M, Gray K, Rosenberg-Thompson S, Carusi D, Gornbein J. The Neuropsychiatric Inventory: Comprehensive assessment of psychopathology in dementia. Neurology. 1994;44(12):2308-2308.
5. Lai C. The merits and problems of Neuropsychiatric Inventory as an assessment tool in people with dementia and other neurological disorders. Clinical Interventions in Aging. 2014;:1051.

6. Kishi T, Matsunaga S, Iwata N. The effects of memantine on behavioral disturbances in patients with Alzheimer's disease: a meta-analysis. Neuropsychiatric Disease and Treatment. 2017;Volume 13:1909-1928.
7. Wood S, Cummings J, Hsu M, Barclay T, Wheatley M, Yarema K et al. The Use of the Neuropsychiatric Inventory in Nursing Home Residents: Characterization and Measurement. The American Journal of Geriatric Psychiatry. 2000;8(1):75-83.
8. Crossley N, Scott J, Ellison-Wright I, Mechelli A. Neuroimaging distinction between neurological and psychiatric disorders. British Journal of Psychiatry. 2015;207(5):429-434.
9. Butler C. Zeman A.Z. Neurological syndromes which can be mistaken for psychiatric conditions. Journal of Neurology, Neurosurgery & Psychiatry. 2005;76(suppl_1):i31-i38
10. Onyike C. Psychiatric Aspects of Dementia. CONTINUUM: Lifelong Learning in Neurology. 2016;22(2, Dementia):600-614.
11. Algase D, Beck C, Kolanowski A, Whall A, Berent S, Richards K et al. Need-driven dementia-compromised behavior: An alternative view of disruptive behavior. American Journal of Alzheimer's Disease. 1996;11(6):10-19.
12. Smith M, Hall G, Gerdner L, Buckwalter K. Application of the Progressively Lowered Stress Threshold Model Across the Continuum of Care. Nursing Clinics of North America. 2006;41(1):57-81.
13. Kales H, Gitlin L, Lyketsos C. Assessment and management of behavioral and psychological symptoms of dementia. BMJ. 2015;350(mar02 7):h369-h369.
14. Sabat S.R.. A Bio-Psycho-Social Approach to Dementia. In Excellence in Dementia Care: Research into Practice, Revised Edition, edited by M. Downs and B. Bowers, 107-121. New York: Open University/McGraw Hill. 2014
15. Zuidema S, de Jonghe J, Verhey F, Koopmans R. Environmental correlates of neuropsychiatric symptoms in nursing home patients with dementia. International Journal of Geriatric Psychiatry. 2009;:n/a-n/a.
16. Devineni B, Onyike C. Young-Onset Dementia Epidemiology Applied to Neuropsychiatry Practice. Psychiatric Clinics of North America. 2015;38(2):233-248.
17. Blinded for review
18. Sclan S, Reisberg B. Functional Assessment Staging (FAST) in Alzheimer's Disease: Reliability, Validity, and Ordinality. International Psychogeriatrics. 1992;4(3):55-69.
19. Kitwood T. Dementia reconsidered. Buckingham: Open University Press; 1997.
20. Spector A, Orrell M. Using a biopsychosocial model of dementia as a tool to guide clinical practice. International Psychogeriatrics. 2010;22(6):957-965.
21. Brooker D. Person-Centred Dementia Care: Making Services Better. Jessica Kingsley Publishers, London. 2007
22. Krippendorff K. Estimating the Reliability, Systematic Error and Random Error of Interval Data. Educational and Psychological Measurement. 1970;30(1):61-70.
23. Moniz-Cook E, Hart C, Woods B, Whitaker C, James I, Russell I et al. Challenge Demcare: management of challenging behaviour in dementia at home and in care homes – development, evaluation and implementation of an online individualised intervention for care homes; and a cohort study of specialist community mental health care for families. Programme Grants for Applied Research. 2017;5(15):1-290.

24. Lange R, Hopp G, Kang N. Psychometric properties and factor structure of the Neuropsychiatric Inventory Nursing Home version in an elderly neuropsychiatric population. International Journal of Geriatric Psychiatry. 2004;19(5):440-448.
25. Souchay C. Metamemory in Alzheimer's Disease. Cortex. 2007;43(7):987-1003.
26. Morris R, Mograbi D. Anosognosia, autobiographical memory and self knowledge in Alzheimer's disease. Cortex. 2013;49(6):1553-1565.
27. Morganti F, Soli A, Savoldelli P, Belotti G. The Neuropsychiatric Inventory-Diary Rating Scale (NPI-Diary): A Method for Improving Stability in Assessing Neuropsychiatric Symptoms in Dementia. Dementia and Geriatric Cognitive Disorders Extra. 2018;8(3):306-320.

462 Table 1: Overview of qualitative symptom classifications using the NPI-NH framework

Subscale	Error	Predominantly Psychiatric (PS)	NPI: Cognitive, Environmental, Care (NPI CEC)	Cognitive, Environmental, Care
Delusions	3 (4%)	7 (10%)	57 (83%)	2 (3%)
Hallucinations	0 (0%)	10 (53%)	2 (11%)	7 (37%)
Agitation	2 (2%)	5 (6%)	52 (64%)	22 (27%)
Depression	4 (6%)	22 (33%)	22 (33%)	19 (28%)
Anxiety	3 (4%)	21 (25%)	48 (58%)	11 (13%)
Elation	0 (0%)	0 (0%)	5 (50%)	5 (50%)
Apathy	0 (0%)	2 (5%)	22 (52%)	18 (43%)
Disinhibition	4 (12%)	6 (18%)	16 (48%)	7 (21%)
Irritability	0 (0%)	7 (12%)	44 (76%)	7 (12%)
Aberrant	2 (2%)	17 (21%)	56 (68%)	7 (9%)
Sleep	2 (4%)	0 (0%)	45 (92%)	2 (4%)
Appetite	1 (2%)	4 (7%)	42 (72%)	11 (19%)
Total	21 (3%)	101 (16%)	411 (59%)	118 (22%)

463

464

465

466

467

468

469

470

471

472

473

474

475

476

477

478

479

480

481 Table 2: Classification qualitatively described "other" symptoms defined as predominantly
482 Cognitive involving Environmental triggers or Care interactions (CEC)

Subscale	**O&M**	**PC&C**	**EoN**	**UR**	**Total CEC symptoms (n)**
Delusions	50 (85%)	8 (14%)	1 (2%)	0 (0%)	59
Hallucinations	5 (55%)	1 (11%)	3 (33%)	0 (0%)	9
Agitation	0 (0%)	40 (54%)	32 (43%)	2 (3%)	74
Depression	3 (7%)	0 (0%)	23 (56%)	15 (37%)	41
Anxiety	9 (15%)	15 (25%)	27 (46%)	8 (14%)	59
Elation	1 (10%)	1 (10%)	8 (80%)	0 (0%)	10
Apathy	2 (5%)	2 (5%)	35 (85%)	2 (5%)	41
Disinhibition	0 (0%)	4 (17%)	19 (83%)	0 (0%)	23
Irritability	1 (2%)	13 (25%)	33 (65%)	4 (8%)	51
Aberrant	4 (6%)	1 (2%)	57 (90%)	1 (2%)	63
Sleep	16 (34%)	1 (2%)	30 (63%)	0 (0%)	47
Appetite	9 (17%)	2 (4%)	42 (79%)	0 (0%)	53
Total	100 (19%)	88 (17%)	310 (58%)	32 (6%)	530

483 O&M=Orientation and Memory, PCC= Poor Care and Communication, EoN= Expression of
484 Need, UR= Understandable Reaction

485

Table 3: Total NPI-NH scores (frequency x severity) for each subscale with and without the inclusion of scores derived solely from qualitatively described symptoms

Sub Category	Subscale	Freq x Severity Score
Delusions	Standard score	·88
	Excluding qualitative	·76
Hallucinations	Standard score	·58
	Excluding qualitative	·58
Agitation	Standard score	2·2317
	Excluding qualitative	2·2290
Depression	Standard score	1·1393
	Excluding qualitative	1·1214
Anxiety	Standard score	1·0772
	Excluding qualitative	·9917
Elation	Standard score	·3214
	Excluding qualitative	·3172
Apathy	Standard score	1·5986
	Excluding qualitative	1·5945
Disinhibition	Standard score	·69
	Excluding qualitative	·67
Irritability	Standard score	1·76
	Excluding qualitative	1·73
Aberrant	Standard score	1·8441
	Excluding qualitative	1·8055
Total	**Standard score**	**12·1159**
	Excluding qualitative	**11·7834**

*significant group difference using t-test at p<·05 ** significant group difference using t-test at p<·01